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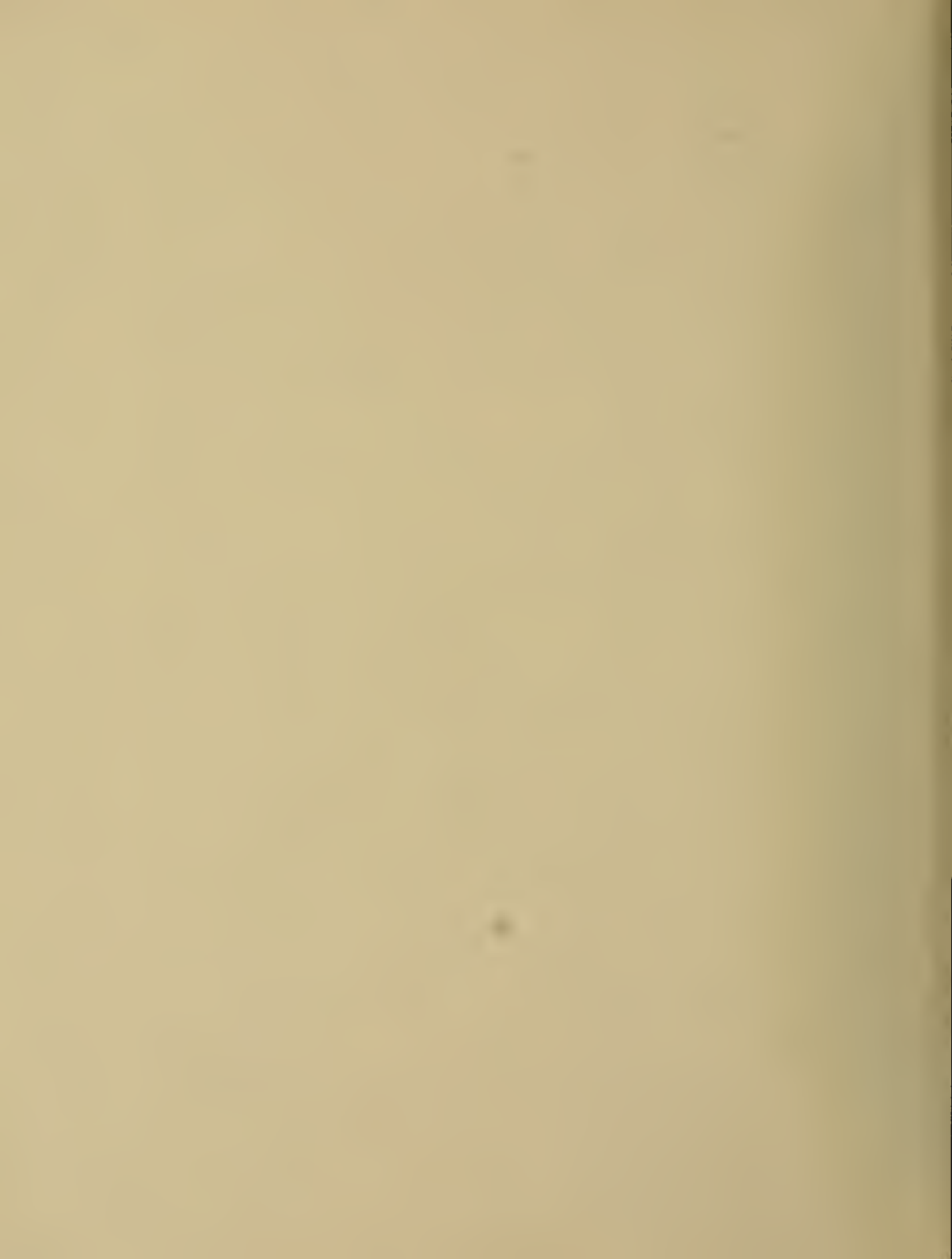
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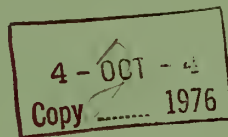


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**Bibliography of Investment Costs,
Operating Costs, and Related
Economic Information for the Mineral
Industries, January-December 1975**



UNITED STATES DEPARTMENT OF THE INTERIOR



U.S. Bureau of Mines
Information Circular 8716

Bibliography of Investment Costs, Operating Costs, and Related Economic Information for the Mineral Industries, January-December 1975

By Joseph Sabatini and L. A. Conley
Process Evaluation Group, Bureau of Mines,
Morgantown, W. Va.



UNITED STATES DEPARTMENT OF THE INTERIOR
Thomas S. Kleppe, Secretary
BUREAU OF MINES
Thomas V. Falkie, Director

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BIBLIOGRAPHY OF INVESTMENT COSTS, OPERATING COSTS,
AND RELATED ECONOMIC INFORMATION FOR THE MINERAL
INDUSTRIES, JANUARY-DECEMBER 1975

by

Joseph Sabatini and L. A. Conley

INTRODUCTION

This report, covering the period January through December 1975, contains abstracts of articles concerning all phases of cost engineering and economics for chemicals processing, mining, and other mineral industries. The abstracts are collected from the following sources:

1. Chemical Engineering
2. Chemical Engineering Progress
3. Chemtech
4. Coal Age
5. Coal Mining and Processing
6. Combustion
7. Drilling
8. Electrical World
9. Engineering and Mining Journal
10. The Engineering Economist
11. Hydrocarbon Processing
12. Journal of Air Pollution Control Association
13. Journal of Metals
14. Journal of Petroleum Technology
15. Mechanical Engineering
16. Mining Congress Journal
17. Mining Engineering
18. Oil and Gas Journal
19. Petroleum Engineering
20. Pipeline and Gas Journal
21. Pit and Quarry
22. Power Engineering
23. Rock Products
24. Water and Sewage Works
25. World Oil

¹Economist.

²General clerk.

The purpose of collecting recent items of economic interest is to provide a source of concentrated information that can be used for reference. The broad perspective that is needed to coordinate occurrences affecting the mineral economy requires this type of surveillance if those occurrences are to be relevant for understanding.

The bibliography has a major emphasis on energy-related activities, and many abstracts give investment and operating costs for synthetic fuels plants, oil and gas exploration and production, underground and surface coal mining and reclamation, and nuclear and conventional power generation facilities. Some other subjects covered include cost estimating methods and theory, reports on construction projects in the United States and abroad, developments in the environmental control segment of the energy economy, progress in solar and geothermal energy development, deep ocean mining, and logistics in the energy market.

Some interesting items included in this bibliography are listed below:

1. Articles pertinent to financial analysis and accounting techniques are items 12, 13, 24, 80, 184, 221, and 245.
2. Coal conversion processes are abstracted in items 5, 26, 32, 56, 57, 59, 63, 214, and 249.
3. Articles concerning underground and strip coal mining appear in items 10, 13, 20, 27, 51, 84, 104, 105, 137, 164, 192, 193, and 222.

BIBLIOGRAPHY

A

1. Abidi, F. Pipeline-System Costs Estimated. Oil and Gas J., v. 73, No. 41, Oct. 13, 1975, pp. 99-100.

Installation costs of pipeline compressor systems are studied as a part of total cost. Construction and freight are among the cost elements viewed.

2. Abramowitz, J. L., and R. Cordero. How To Select Insulation for Hot Pipes. Chem. Eng., v. 82, No. 15, July 21, 1975, pp. 88-96.

Economic guidelines are set up for use in selecting pipe insulation. A series of nomographs relates insulation thickness to annual energy cost, annual capital cost, and total cost. Other graphs relate temperatures and materials to costs.

3. Adams, E. Foreign Investment Paces Increase. Pipeline and Gas J., v. 202, No. 9, July 15, 1975, pp. 16-17.

The author predicts that 1975 will be a record-breaking year for capital investments in the energy industry. A chart shows estimated capital and exploratory expenditures for facilities and reserves in the United States and abroad.

4. ———. Regulatory Costs Hit Companies. Pipeline and Gas J., v. 202, No. 7, June 1975, pp. 112-116.

Loss of oil depletion allowance, continuing inflation, and government price controls and tax changes are squeezing oil company profits. Specific factors that incur these regulatory costs are analyzed, and dollar figures are given for a few companies.

5. Alich, J. A., Jr., R. L. Dickenson, and N. Korens. Suitability of Low Btu Gas/Combined Cycle Electric Power Generation for Intermediate Load Service. Combustion, v. 46, No. 10, April 1975, pp. 8-16.

The economics of low-Btu gas/combined cycle power generation for intermediate load service is compared with the economics of alternative methods. Capital investment figures are given for various processes converting high-sulfur coal and high-sulfur residual oil to low-Btu gas. Operating, maintenance, and administrative costs are also presented for integrated and nonintegrated gasification systems.

6. Allen, D. H., and R. C. Page. Revised Technique For Predesign Cost Estimating. Chem. Eng., v. 82, No. 5, Mar. 3, 1975, pp. 142-150.

A new cost estimating technique for chemical plants is the subject of this article. By comparing different methods, the authors determine how a complete, effective procedure can be developed. A summary of their procedure begins with a plant flowsheet, total process stream input, temperature and pressure conditions, etc.

7. Aude, T. C., T. L. Thompson, and E. J. Wasp. Slurry-Pipeline Systems for Coal, Other Solids Come of Age. Oil and Gas J., v. 73, No. 29, July 21, 1975, pp. 66-72.

Capital, operating, and maintenance costs are discussed for coal transportation systems. Rail and unit train facilities are compared with slurry pipelines from technical and economic standpoints. Some discussion on how inflation and tariffs affect costs is included.

B

8. Bachman, W. A. New Surge in Oil Spending Planned for U.S., If... Oil and Gas J., v. 73, No. 5, Feb. 3, 1975, pp. 37-39.

The capital spending budget in the petroleum industry for 1975 is expected to be \$26.2 billion. Refining investments alone will approach \$3.1 billion. Pipelines will account for about \$2.3 billion in investments.

9. Barlow, J. A. Energy Recovery in a Petrochemical Plant. Chem. Eng., v. 82, No. 14, July 7, 1975, pp. 93-97.

Capital and operating costs are compared for prime movers. Electric drive units are compared with gas and steam turbine units. Lowest total cost accompanies gas turbine drives.

10. Barnes, B. Changing Parts Ahead of Time Saves Production Costs in Long Run. Coal Age, v. 80, No. 11, October 1975, pp. 117-118.

Coal mine production costs can be reduced when downtime is decreased by preventive maintenance. Mine supervisors avoid losses by replacing abrasion worn parts ahead of schedule. Examples are given.

11. Barr, R. C. What is the Outlook for Geothermal Power? Oil and Gas J., v. 73, No. 19, May 12, 1975, pp. 148-151.

Electrical power generation costs are broken down to capital, operating, and fuel for geothermal powerplants. Geothermal capital costs are given for U.S. geysers, hot water in Otake, Japan, and hot water in Cerro Prieto, Mexico. Structures and turbogenerators make up the bulk of costs for each.

12. Beenhaker, H. L. Sensitivity Analysis of the Present Value of a Project. Eng. Econ., v. 20, No. 2, Winter 1975, pp. 123-128.

This highly sophisticated presentation uses advanced mathematical techniques to aid in capital investment decision making and planning. The sensitivity analysis involves the effects of delays in securing financial resources, delays in procurement, etc., on the discounted present value of a project.

13. Belton, A. E. Evaluation of Underground Coal Haulage Systems. Min. Cong. J., v. 61, No. 10, October 1975, pp. 52-56.

The haulage system for an underground coal mine constitutes a large percentage of overall mining costs. Capital costs for haulage systems are compared on a length basis, and labor, supplies, depreciation, and other costs are broken down as percentages of total cost.

14. Bhappu, R. B., and M. F. Lewis. Gold Extraction From Low Grade Ores--Economic Evaluation of Processes. Min. Cong. J., v. 61, No. 1, January 1975, pp. 38-41.

A number of different processes exist for extracting gold from gold ore. Capital and operating costs for some of them are shown. Consideration of market factors generates data useful in determining return on investment time, and comparative economics for the processes mentioned provide criteria for selection.

15. Billon, A., G. Heinrich, A. Hennico, and P. Bonnifay. Cleaning Up the Bottom of the Barrel. Combustion, v. 46, No. 11, May 1975, pp. 8-12.

Different methods for desulfurizing light Arabian atmospheric residual oil are discussed. Economics of the processes are presented in tables showing utility, fuel, power, and steam consumption, and costs. A total investment figure of \$3.1 million is given for a vacuum distillation process. Investment figures for other processes are included.

16. Blessing, J. A. One Way Out of the Capital Crunch. Coal Min. and Process., v. 12, No. 3, March 1975, pp. 46-47.

The author suggests that leasing, rather than buying, high-cost mining equipment saves capital funds for more productive and profitable uses. Leasing allows management to conserve working capital and borrowing capacity, thus providing sources of available cash.

17. Bonano, D. R. Cost Escalation: Its Impact on Purchased Equipment. Chem. Eng., v. 82, No. 14, July 7, 1975, pp. 81-83.

Procedures for coping with rapidly changing prices of chemical processing equipment are discussed. Using typical labor and material cost indexes, a formula is derived for determining price adjustments.

18. Brownstein, A. M. Economics of Ethylene Glycol Processes. Chem. Eng. Prog., v. 71, No. 9, September 1975, pp. 72-76.

Different processes for producing ethylene glycol are studied with comparative economics given. Raw material, utility, and operating costs are broken down for their respective processes.

19. Budwani, R. N. Nuclear Power Plants: What It Takes To Get Them Built. Power Eng., v. 79, No. 6, June 1975, pp. 39-45.

Many measures can be taken to cut costs in construction and operation of nuclear powerplants. The study involved breaks plants down into material, manpower, and capital components to analyze how much is needed in each area and what measures can be taken to control costs.

20. Butler, J. M., and R. K. Fouts. Optimizing Open Pit Mining With Computer Simulation. Min. Cong. J., v. 61, No. 3, March 1975, pp. 32-36.

Some operating cost estimates are presented for open pit mining operations. Consideration is given to such items as fuel, electricity, wages, tires, and haulage systems. Most estimates use capacity as a basis for comparison.

C

21. Caldwell, D. W., and H. J. Ortego. A Method for Forecasting the CE Plant Cost Index. Chem. Eng., v. 82, No. 14, July 7, 1975, pp. 83-85.

The authors use a new approach for gaining insight into the movements of the chemical plant cost index. This involves comparison of the index history to broad price indexes such as Gross National Product Deflator and Consumer Price Index. This macroeconomic approach may provide a more realistic cost adjusting mechanism.

22. Call, W. L. An Evaluation of Cost Standards for Joint Products. Eng. Econ., v. 20, No. 3, Spring 1975, pp. 187-195.

The important criterion for setting any standard of performance is that it be consistent with the overall goals of a firm. The author suggests that conventional cost standards, when applied to joint products, violate this criterion in that they cause business to compare actual results with arbitrary standards. A solution

to this problem is suggested in the form of a flexible budget for joint products.

23. Carameros, G. D. Trans-Alaskan Gas Pipeline Offers Security, Economic Benefits. Pipeline and Gas J., v. 202, No. 10, August 1975, pp. 57-58.

The capital cost of the trans-Alaska gas project is estimated at \$6.7 billion. One economic benefit of the project is that it will provide employment for many American workers. Other aspects of the project are discussed.

24. Cason, R. L. Go Broke While Showing a Profit. Hydrocarbon Process., v. 54, No. 7, July 1975, pp. 179-190.

Different accounting practices and economic indicators are the subject of the article. Profit and loss statements, cash flow, the effect of inflation on working capital, and depreciation are among the items of interest.

25. Chambers, W. E. Low-Cost High-Performance Carbon Fibers. Mech. Eng., v. 97, No. 12, December 1975, pp. 37-41.

Carbon fibers have many uses that range from clothes to rocket parts. Strength is the primary characteristic that gives interest to the different strands and specifications. Selling price of fibers has declined steadily over time, from \$500 per pound to \$40-\$50 per pound. Costs associated with production are discussed.

26. Chemical Week. South Africa Pours on the Coal. V. 116, No. 4, Jan. 22, 1975, p. 36.

The government-controlled Coal Oil and Gas Corp. (Sasol) is building a plant to make fuel and chemicals from coal in South Africa. The capital cost is expected to be \$1.5 billion.

27. Chironis, N. P. Three Innovations in Mine Expansion Tested at Bruceton Experimental Mine. Coal Age, v. 80, No. 4, April 1975, pp. 108-113.

A new system called "Radmark" mines and conveys coal pneumatically from the working face to the surface and requires only a three-man operation. The system is being developed by the McCarthy Engineering Construction Co., Tulsa, Okla., in conjunction with the Federal Bureau of Mines at the Bruceton experimental mine in Bruceton, Pa. The capital cost of such a system is between \$80,000 and \$90,000.

28. Clark, F. D. How To Assess Inflation of Plant Costs--Cost Control for Process Plants From the Owner's View. Chem. Eng., v. 82, No. 14, July 7, 1975, pp. 70-77.

Engineering and construction costs for chemical process plants are subject to rapid escalation. An owner must be certain that a contractor is exercising effective cost control procedures and must enforce mechanisms for achieving corrective cost actions. These and other subjects relating to cost control are viewed.

29. Coal Age. New Labor Contract Provides Wages, Safety, Pension Improvements. V. 80, No. 1, January 1975, pp. 57-59.

The terms of the 1974 United Mine Workers of America contract are expected to raise the coal industry's labor cost by \$4.6 billion over a 3-year period. Various aspects of the agreement are discussed.

30. Combustion. The Year of the Cutback--Industry Report 1974-75. V. 46, No. 12, June 1975, pp. 10-23.

Powerplant construction costs have escalated at more than 15 percent per year since 1970. They now range from about \$600 to \$1,000 per kilowatt of capacity. Nuclear powerplant costs seem to be lower when compared with fossil fuel costs. Costs are broken down in tables for elementary economic analysis.

31. Congram, G. E. Refiners Whittle Down Fuel Costs. Oil and Gas J., v. 73, No. 15, Apr. 14, 1975, pp. 57-58.

Oil refiners are attempting to recover billions of Btu lost up the stacks of their process equipment in attempts to reduce fuel costs. Different methods of achieving that goal are discussed.

32. Conn, A. L. Coal Poses the Greatest Challenge and Opportunity. Chem. Eng. Prog., v. 71, No. 6, June 1975, pp. 19-21.

The author states that within 5 years the United States will have reliable coal gasification processes, and the main problem delaying development will be economics. Large capital requirements will make it difficult to realize the full potential of gasification. Some suggestions on how to alleviate problems are included.

33. Cronan, C. S. Our Broader Outlook. Chem. Eng., v. 82, No. 3, Feb. 3, 1975, p. 5.

In any process engineering work, energy and material balances receive primary consideration. Ample supplies of feed materials and energy used to be assumed. However, changes in availability and costs for both items are becoming more and more important and will require process engineering to adopt a newer approach. Some suggestions are included.

34. Cross, T. A. Design Key To Good Insulation Systems. Oil and Gas J., v. 73, No. 11, Mar. 17, 1975, pp. 126-131.

Insulation of vessels storing heated liquids is becoming more important with rising energy costs. Insulation economics is valuable knowledge for making investment decisions. Translated into return on investment (ROI), \$1.50 per square foot of insulation represents 30.6 percent. Other aspects are viewed.

35. _____. Economics Dictate Tank Insulation. Oil and Gas J., v. 73, No. 35, Sept. 1, 1975, pp. 73-77.

A fairly complete look at tank insulation to conserve energy is presented. Insulation materials are compared on the basis of thermal conductivity, installed cost, weather tightness, etc. Return on investment analysis is provided for two insulation projects, and insulation economics for different tank types are compared.

D

36. Davidson, L. B. Investment Evaluation Under Conditions of Inflation. J. Petrol. Technol., v. 27, October 1975, pp. 1183-1189.

The author attempts to incorporate inflation factors into present value studies for the purpose of evaluating investments. Uncertainty and other factors are also considered.

37. Davis, K. W. Converter Reactor Alternatives. Combustion, v. 46, No. 12, June 1975, pp. 25-31.

Capital requirements for coal versus nuclear power generating plants are given in dollars per kilowatt of generating capacity for plants on the order of 2,000 megawatts. Although powerplant capital costs appear to be 15 to 19 percent lower for coal, the overall capital requirements for both systems are about the same because of coal mining costs and unit train transport and loading facilities.

38. Deul, M. Recover Coalbed Gas. Hydrocarbon Process., v. 54, No. 7, July 1975, pp. 86-87.

Many physical characteristics of U.S. coal resources make them economically attractive for the recovery of coalbed gas. Since most beds are at depths of 3,000 feet or less, drilling cost advantages ensue. Also, most coal deposits in Appalachia and the Central States are close to large population centers insuring low-cost transmission and delivery.

39. Deul, M., and A. G. Kim. Coal Beds - A Source of Natural Gas. Oil and Gas J., v. 73, No. 24, June 16, 1975, pp. 47-49.

Coalbeds are capable of yielding great amounts of natural gas. Exploration costs for this gas are very low, and most beds are

relatively shallow, requiring low capital investment. When and where a mine shaft can be sunk several years in advance of mining, it can be used for degasification of the coal at a cost of about \$100,000.

40. _____. Methane in Coal: From Liability to Asset. Min. Cong. J., v. 61, No. 11, November 1975, pp. 28-32.

Costs of draining methane from unmined coalbeds is the subject studied. Recovery costs vary with drainage methods and the market value of recovered gas.

41. Downing, P. B., and W. B. Watson, Jr. Cost Effective Enforcement of Environmental Standards. J. APCA, v. 25, No. 7, July 1975, pp. 705-710.

The authors take a look at firm behavior under the impacts of legal enforcement of environmental standards, enforcement through economic incentives, and mixed legal-economic enforcement. The primary concern is to minimize resource costs to firms by employing a cost-efficient enforcing system. Enforcement systems are examined, and cost comparisons are made.

42. Drilling. The Rising Cost of Completed Wells. V. 36, No. 3, January 1975, p. 50.

This is an update of price indexes for items included in the cost index of drilling and equipping wells. Casing tubing and casing hardware make up 18 percent of total well costs.

43. Dunn, K. S. Incineration's Role in Ultimate Disposal of Process Wastes. Chem. Eng., v. 82, No. 21, Oct. 6, 1975, pp. 141-150.

Some discussion on costs of systems using incinerators to dispose of solid wastes is presented.

E

44. Edwards, A. G. Adequate Formation Testing Can Reduce Completion Costs. World Oil, v. 181, No. 5, October 1975, pp. 83-89.

A test to determine whether a given oil well contains substantial amounts of hydrogen sulfide or carbon dioxide before completion may result in savings of \$500,000 or more. A test indication that these are absent would permit the operator to eliminate high-cost, corrosion-resistant materials.

45. Electrical World. Economic Study Favors 34.5 KV. V. 183, No. 10, May 15, 1975, pp. 54-57.

Investment and annual operating costs are compared for different size power generating units. Capital costs are viewed for 12.5-, 24.9-, and 34.9-kilovolt units, together with annual fixed costs and maintenance for each capacity. The analysis concludes that the 34.5-kilovolt system is most economical in the long run.

46. _____. Energy-Conscious Design Lowers Costs. V. 184, No. 5, Sept. 1, 1975, pp. 72-73.

Some recommendations for conserving energy involve the example of an all-electric office building now under construction for the consulting engineering firm of Black and Veatch. Principal design features will involve initial capital cost savings of \$260,000 and annual energy savings of \$15,000. Maintenance costs will also be reduced.

47. _____. Small Urban Energy Stations To Burn Coal. V. 183, No. 2, Jan. 15, 1975, pp. 74-76.

This article estimates the cost of a fluidized-bed combustion facility to be about \$400 per kilowatt of capacity. Production units will cost more than traditional combustion turbines or engine generators.

48. _____. Sprayed Polyurethane Cuts Tank-Heating Costs. V. 184, No. 4, Aug. 15, 1975, pp. 35-36.

An experiment in the use of urethane-foam insulation has resulted in a 98-percent savings in the cost of fuel used to heat oil in two 10,000-barrel, No. 6 fuel oil storage tanks. The oil is heated to keep it at the proper viscosity. Paul Timbrook, manager of maintenance engineering, Kendall/Amalie Div., Witco Chemical Corp., reported the experimental results stating that the insulation reduced the heating cost of each tank from \$26,700 to \$200 per year.

49. _____. Titanium Tubes Cut Costs Even in Average Water. V. 183, No. 4, Feb. 15, 1975, pp. 44-46.

The corrosion resistance of titanium makes it an attractive material for heat exchanger and surface condenser tubing. The metal's reliability and availability make it very cost effective. Various applications and uses for titanium are discussed.

50. Enright, R. J. Soaring Costs, Taxes Slow Oil Development in North Sea. Oil and Gas J., v. 73, No. 26, June 30, 1975, pp. 73-78.

North Sea oil production is experiencing difficulties due to high costs, increasing taxes, and declining world crude price. Past years held development costs from \$1,400 to \$2,500 per daily barrel of production capacity. The present figure is nearer \$4,500 per daily barrel and in some areas is reaching \$7,000.

51. Epstein, B. S. Financing the Acquisition of a Going Coal Mine. Min. Eng., v. 27, No. 9, September 1975, pp. 37-39.

Examining the financial situation of a going coal mine is necessary for determining the available sources of investment funds and the overall profitability of the project. The author discusses evaluation procedures relative to these objectives.

52. Erdahl, L. O. Economic Aspects of Joint Ventures. Min. Eng., v. 27, No. 9, September 1975, pp. 33-35.

Increasing problems in the economy are creating much difficulty for the mining industry. Huge capital outlays for environmental controls and shortages of energy, manpower, etc., are making the prospect of joint mining ventures appear as an increasingly attractive endeavor to many companies. Joint venture economics are examined in detail.

53. Evans, R. R., and R. S. Millward. Equipment for Dewatering Waste Streams. Chem. Eng., v. 82, No. 21, Oct. 6, 1975, pp. 83-87.

Dewatering of waste fluids concentrates waste products to be handled as a sludge. Equipment for carrying out this procedure is described. Capital and operating costs are discussed, and comparisons are made to show cost advantages.

54. Ewing, R. C. Pipeline Economics. Oil and Gas J., v. 73, No. 33, Aug. 18, 1975, pp. 61-100.

This is the Oil and Gas Journal's 18th annual report on pipeline installation and equipment costs. Specific pipeline projects are cited with relative cost information. Other items of interest include pipeline cost indexes for material and machinery and cost forecasts for the same.

55. Ewing, R. L. Computerized Sewer Design: New Tool for an Old Problem. Water and Sewage Works, v. 122, No. 4, April 1975, pp. 67-69.

This report concerns a computer model used for determining cost alternatives in sewer design. The cost comparisons aid in construction and engineering decision making.

F

56. Ferretti, E. J. Developing Clean Energy From Coal. Coal Min. and Process., v. 12, No. 3, March 1975, pp. 48-51, 62.

In this report, coal gasification costs are estimated to be between \$1.50 and \$2.10 per million Btu for high-Btu gas and between

\$1 and \$1.60 per million Btu for low-Btu gas. These costs are based on operations at the mine mouth. Coal liquefaction costs are estimated in the \$9-per-barrel area.

57. _____. Developing Industrial Fuel Gas From Coal. Coal Min. and Process., v. 12, No. 11, November 1975, pp. 46-49, 64-65.

Major cost items for an industrial fuel gas plant are shown. Equipment and materials account for nearly two-thirds of the total cost. It is noted that costs are constantly increasing.

58. Ferretti, E. J., K. C. Baczewski, and A. C. Mengon. Coal Gasification Will Not be Cheap, But Compulsory. Coal Min. and Process., v. 12, No. 7, July 1975, pp. 46-51.

In a table included in this article, synthetic gas economics is examined for synthetic natural fuel, industrial fuel, and low-Btu fuel. Economic parameters include plant size, plant investment, input coal cost, manufacturing cost, and gas cost utility financing. Costs are given in dollars per million Btu.

59. Ferretti, E. J., and S. Kasper. The Current Status of Coal Gasification. Coal Min. and Process., v. 12, No. 12, December 1975, pp. 74-76.

A review of coal gasification processes to produce low-, medium-, and high-Btu gas is presented. Capital costs and gas selling price per thousand cubic feet are among the items discussed.

60. Fishwick, J. P. Coal and the Railroads. Coal Min. and Process., v. 12, No. 1, January 1975, pp. 62-63.

The Norfolk and Western railroad has begun construction on 2,000 new coal hopper cars at a cost of \$35.6 million. Delivery of 66 new 3,000-horsepower locomotives will add \$26.7 million to the investment. Improving turnaround time for these cars will mean more trips and a better return on capital.

61. Fox, C. R. Remove and Recover Phenol. Hydrocarbon Process., v. 54, No. 7, July 1975, pp. 109-111.

The Rohm and Haas Co. of Philadelphia, Pa., has developed a new process for efficiently removing phenol from aqueous waste solutions. Capital and operating costs of the system are given.

62. Frohling, E. S., and R. M. McGeorge. How Stepwise Financing Can Turn Your Prospect Into an Operating Mine. Min. Eng., v. 27, No. 9, September 1975, pp. 30-32.

The authors suggest that the financing of capital projects in phases may aid in establishing a desired mining operation. Sources of funds are discussed for both debt and equity financing.

63. Fumich, G., Jr. Clean Energy From Coal, Mech. Eng., v. 97, No. 6, June 1975, pp. 14-21.

Different coal gasification processes are discussed with respect to environment, technology, and economics. Achieving higher thermal efficiency in plants lowers operating costs and is constantly being studied.

G

64. Galey, G. G. Pipelines Versus Unit Trains. Coal Min. and Process., v. 12, No. 1, January 1975, pp. 64-65, 74, 81.

This article concerns investments in pipelines versus investments in unit trains. A proposed pipeline between northeastern Wyoming and central Arkansas would cost between \$600 and \$750 million. The same shipment by rail would involve about \$350 million capitalized cost. However, the train would have an excess capacity involving an opportunity cost.

65. Ganapathy, V. Nomogram Determines Total Fuel Cost From Unit Cost, Heating Value, and Heat Rate. Power Eng., v. 79, No. 5, May 1975, p. 52.

The nomogram is a useful tool for finding total annual fuel costs for powerplant boilers. The total cost is arrived at by coordinating different variables such as unit fuel cost, heating value, unit rating, heat rate, and number of operating hours.

66. Gates, L. E., T. L. Henley, and J. G. Fenic. How To Select the Optimum Turbine Agitator. Chem. Eng., v. 82, No. 26, Dec. 8, 1975, pp. 110-114.

Turbine blades for liquid agitation are evaluated for process uses. Mechanical design and cost estimations are considered.

67. Geffen, T. M. Here's What's Needed To Get Tertiary Recovery Going. World Oil, v. 180, No. 4, March 1975, pp. 53-57.

Some discussion on the costs of tertiary recovery of oil is contained in this article. Added cost, above-well operating expense for a barrel of tertiary oil, ranges from \$0.75 to \$1.50 under perfect conditions.

68. Genco, J. M., H. S. Rosenberg, M. Y. Anastas, E. C. Rosar, and J. M. Dulin. The Use of Nahcolite Ore and Bag Filters for Sulfur Dioxide Control. J. APCA, v. 25, No. 12, December 1975, pp. 1244-1253.

Technical and economic aspects of the nahcolite ore injection process are discussed. Fly ash and sulfur oxides are removed from stack gases, using ore injection. Capital and operating cost figures are given.

69. Gentry D. W. The Buy-or-Lease Decision for Capital Equipment. Min. Eng., v. 27, No. 9, September 1975, pp. 39-43.

One economic problem of the mining industry involves the decision whether to buy or lease high-cost capital equipment. An evaluation model for the buy-or-lease decision, using present worth analysis, is presented.

70. Gerstin, R. A. A Technical and Economic Overview of the Benefits of Repowering. Combustion, v. 46, No. 10, April 1975, pp. 17-22.

"Repowering" is the term used to describe a procedure by which old steam turbines and boilers are scrapped and replaced by a combustion turbine and reduction gear. The new turbine drives old steam turbine generators. The details are discussed with a complete section on the economics of "repowering." A typical repowering system is estimated to cost about \$140 per kilowatt of generating capacity.

71. Gilbert, J. B., C. Olavesen, C. H. Holder, and J. Lecomte. Hydro-processing for White Oils. Chem. Eng., v. 82, No. 19, Sept. 15, 1975, pp. 87-89.

A new two-stage catalytic hydrogenation process for producing medicinal-(or food) and technical-grade white oils has been developed by Exxon Research and Engineering Co. Investment and operating cost estimates are given for a plant producing 15 million gallons of white oil per year.

72. Goar, G. Sulfur Recovery From Natural Gas Involves Big Investment. Oil and Gas J., v. 73, No. 28, July 14, 1975, pp. 79-85.

A number of processes exist for removing sulfur from natural gas, all involving high investment costs. A hypothetical case is examined with respect to investment costs that approach \$6 million.

73. Goar, G. B. Costs Air Regulations Affect Process Choice--Clause Tail-Gas Cleanup. Part 1 of 2 Parts. Oil and Gas J., v. 73, No. 33, Aug. 18, 1975, pp. 109-112.

Estimated investment costs for Trenclo-M-type Claus tail-gas cleanup plants are given. Costs range from \$760,000 to \$2,600,000.

74. Goosens, A. G., R. F. Westerduin, and A. Mol. High Fuel Costs Push Reevaluation in Ethylene Process. Oil and Gas J., v. 73, No. 34, Aug. 25, 1975, pp. 92-95.

Operating cost is broken down for olefin plants showing feed cost, investment, depreciation, and utilities costs. Higher oil prices are making feedstocks a more significant factor than construction cost and labor.

75. Grace, J. A., and K. C. Khurana. Investing Capital for Energy Savings. Oil and Gas J., v. 73, No. 35, Sept. 7, 1975, pp. 105-106, 109-110.

Capital investment in instrumentation, draft combustion, insulation, and other areas of oil refinery operation are necessary for energy conservation and lower costs. Techniques are discussed with related investment costs.

76. Grace, R. D. How To Avoid Intuitive Decisions and Cut Drilling Costs. Oil and Gas J., v. 73, No. 12, Mar. 24, 1975, pp. 68-69.

Some oil well drilling costs are given, including drill bit cost per foot. Cost data based on actual performance, not intuition, are the suggested basis for rotary speed and drill bit selection.

77. Grebbell, J. Process Lowers Cost of N-Paraffins. Oil and Gas J., v. 73, No. 15, Apr. 14, 1975, pp. 85-86, 90, 92, 101.

Capital and operating costs are compared for two different processes for molecular sieve separation of *n*-paraffins. Process descriptions are included.

78. Guccione, E. What Government Has Done to Your Financial Resources. Min. Eng., v. 27, No. 9, September 1975, pp. 26-30.

Lack of capital in the mining industry is the problem analyzed by W. H. Hillendahl, vice president and director of business research for the Bank of Hawaii. Hillendahl places much of the blame on government spending and bureaucratic controls, stating that the Federal government is ever increasing an artificial credit base.

H

79. Hale, D. World Pipeline Outlook. Pipeline and Gas J., v. 202, No. 1, January 1975, pp. 34-46.

This report contains information showing domestic and international flows of gas, crude oil, and slurries. Particular projects are cited with related cost information.

80. Hall, W. B. Polar Mining. Min. Cong. J., v. 61, No. 7, July 1975, pp. 46-51.

This article lists prospective mining deposits, probable operating difficulties, and techniques for polar regions. It discusses actual mining, past and present, for the Arctic region. It includes a Federal Bureau of Mines comparison of the costs of mining asbestos in the Clinton mine in the Yukon territory with those of mining asbestos in Alaska. The price necessary to yield a 12-percent discounted cash flow for Alaskan fiber is estimated at \$364 per ton, which is 29 percent higher than the \$283 estimated for Yukon fiber.

81. Hanf, E. W., and J. W. MacDonald. Economic Evaluation of Wet Scrubbers. Chem. Eng. Prog., v. 71, No. 3, March 1975, pp. 48-52.

A variety of wet scrubbers exists for removing particulate matter from polluted air. Charts are provided comparing technical aspects of the scrubbers, and cost comparisons are made as criteria for selection.

82. Hannigan, J. T. Combined Waste Treatment Proves Economical and Feasible. Water and Sewage Works, v. 122, No. 11, November 1975, pp. 38-41.

Details of a method are given for treating industrial and domestic waste water simultaneously. A cost comparison is made between the proposed and alternate projects showing operating and maintenance cost advantages.

83. Hastings, K. E., L. C. James, and W. R. Mounce. Demetallization Cuts Desulfurization Costs. Oil and Gas J., v. 73, No. 26, June 30, 1975, pp. 122, 127-128, 130.

High metal content (mostly vanadium and nickel) in residual oils makes desulfurization difficult and expensive because the metals deactivate desulfurizing catalysts by covering them with metal sulfides. Procedures for removing these metals are discussed, and cost comparisons are made for desulfurization with and without demetallization.

84. Haynes, R. M. Manning the Coal Mines. Min. Cong. J., v. 61, No. 11, November 1975, pp. 39-41.

Labor and training costs for underground coal miners are treated as an investment. Total annual cost of manning a mine is the issue, and training as a way of cost control is discussed.

85. Hayward, G. J., and P. N. Hoggett. Ethylene - Plant Feedstock Flexibility is Justified. Oil and Gas J., v. 73, No. 30, July 28, 1975, pp. 81-84.

Building a flexible ethylene plant that will accommodate different feedstocks requires higher capital investment than a single feed plant. Shortages and other availability problems, however, justify building a versatile plant. Flowsheets and cost penalty charts are used to illustrate the case.

86. Herod, B. C., and J. G. Kostka. Aggregates, Other Major Non-Metals. Pit and Quarry, v. 67, No. 7, July 1975, pp. 68-77.

Price information and forecasting is available here for mineral aggregates--gypsum, phosphate, potash, talc, feldspar, barite, and other industrial minerals.

87. Hoffman, L., F. L. Brown, and J. D. Baxter. New Way To Measure Price Elasticity. Electrical World, v. 184, No. 11, December 1975, pp. 52-54.

Price elasticity of a commodity is a measurement of aggregate consumption response of a group of customers to a change in price of that commodity. A new method for measuring price elasticity of electricity is given.

88. Hoover, M. G. Wastewater Collection System Criteria - Part II. Water and Sewage Works, v. 122, No. 4, April 1975, pp. 70-72.

Reducing infiltration/inflow in sewerage systems yields savings in operating and maintenance costs. A chart is provided here to show how to compute annual savings using present worth and compound amount factors.

89. Hopkins, P. S., and F. L. Greve. Process Energy Savings: Complex but Rewarding. Oil and Gas J., v. 73, No. 35, Sept. 1, 1975, pp. 77-80.

The authors suggest that fuel-cost savings are some 40 percent higher in the process equipment area than in heaters for refineries. However, investigating process units is more difficult and requires higher capital investment. Details are outlined for certain process areas.

90. _____. Refinery Energy Saving - Energy-Savings Projects Can Yield Some Big Returns. Oil and Gas J., v. 73, No. 29, July 21, 1975, pp. 73-76.

Refinery energy savings of \$649,000 per year could result from the implementation of some relatively low capital cost energy-conservation projects. The authors present results of a 2-1/2-month study that outlines what steps must be taken to realize this saving.

91. Horton, W. A., and Z. J. Andracki. Reconstruct Towers To Upgrade Line. *Electrical World*, v. 184, No. 3, Aug. 1, 1975, pp. 62-64.

Increasing electrical power transmission capacity is difficult owing to the various problem areas encountered. Higher construction costs, rights-of way, environmental problems, and natural obstacles contribute to the difficulties. One suggested solution is to increase existing lines to higher voltage operation. The authors outline a voltage conversion procedure and include an economic analysis quoting a unit cost per mile of 66 cents.

92. Hosoi, T., and H. G. Keister. Ethylene From Crude Oil. *Chem. Eng. Prog.*, v. 71, No. 11, November 1975, pp. 63-67.

A new process for producing ethylene from crude oil provides a cost advantage of from 1 to 2 cents per pound of product over the conventional naphtha/gas-oil cracking process. Details are given.

93. Hottel, H. C. Solar Energy. *Chem. Eng. Prog.*, v. 71, No. 7, July 1975, pp. 53-65.

Estimated initial capital cost is given for a 100-megawatt-electrical solar power plant at about \$15.5 million in January 1974 dollars. Additional capital cost is estimated at \$73.9 million, bringing the total to \$894 per kilowatt electrical of generating capacity. Other capital and operating costs are given for solar power and are compared with fossil fuel power generation costs.

94. Houghtaling, S. V. Wet Grinding of Phosphate Rock Holds Down Dollars, Dust, and Fuel. *Eng. and Min. J.*, v. 176, No. 1, January 1975, pp. 94-96.

A new process for grinding phosphate rock has been developed by Davy Powergas, Inc., of Lakeland, Fla. The process lowers capital costs, eliminated dust emissions, and saves fuel and power consumption thus reducing operating costs. Savings are estimated at \$3 to \$4.25 per ton of P₂O₅.

95. Hubbell, R. O., and G. A. Derouen. How Five Major Bid Factors Affect Potential Lease Profit. *World Oil*, v. 181, No. 1, July 1975, pp. 67-69.

The rate of return on investment for offshore oil leases is very sensitive to such economic factors as depletion allowance, crude

price variation, and reserve estimate. The discounted cash flow rate of return method is used to generate data for use in a graphical analysis that illustrates this point.

96. Huebler, J. Gasification and Liquefaction of Coal. Min. Cong. J., v. 61, No. 10, October 1975, pp. 16-23.

Synthetic fuels from coal is the subject of the presentation. Various processes for coal gasification and liquefaction are discussed. Some investment costs are given.

97. Hunkin, G. G. The Environmental Impact of Solution Mining for Uranium. Min. Cong. J., v. 61, No. 10, October 1975, pp. 24-27.

Capital cost estimates are given for uranium mining using a new solution mining technique. Costs are considerably lower when compared with conventional mining costs, owing to many operating advantages and uncomplicated land rehabilitation procedures.

98. Hutchins, R. A. Thermal Regeneration Costs. Chem. Eng. Prog., v. 71, No. 5, May 1975, pp. 80-86.

When a granular activated carbon treatment is used to solve a pollution of liquid purification problem, the decision must be made to regenerate the spent carbon or discard it. Regeneration costs are examined, including capital investment, operating cost, and labor expenses. Dollars and cents figures are assigned to processes for elementary economic analysis.

I

99. Iammartino, N. R. Circular-Grate Pelletizer Cuts Costs, Raises Quality. Chem. Eng., v. 82, No. 11, May 26, 1975, pp. 76-77.

A circular-grate pelletizing system for iron ore and other particulate materials has been operating successfully for 1 year. Altos Hornos de Mexico, S.A., operates a 600,000-metric-ton-per-year plant at its mine site at La Perla, Mexico. Capital costs are lower due to design improvements, and cost reductions in operation and maintenance are cited.

100. _____. Freeze Crystallization: New Water-Processing Tool. Chem. Eng., v. 82, No. 13, June 23, 1975, pp. 92-93.

A new process developed by Avco Co.'s Systems Div. employs a freeze crystallization technique that can overcome many pollution problems. By concentrating large volumes of dilute contaminated waste waters into smaller volumes, followup treatment or disposal is made easier. The process, called Crystalex, has an estimated

installed cost of about \$400,000 to \$650,000 for a module with a 100,000-gallon-per-day capacity.

101. _____. Tar-Sand Projects Stuck. Chem. Eng., v. 82, No. 4, Feb. 17, 1975, pp. 44-48.

Early projects in the Canadian tar sands region indicate a need for reevaluation as to their feasibility. Increasing capital costs and other setbacks may make it necessary to wait until the early 1980's for commercial exploitation of this resource. A brief review of individual projects is included.

102. _____. Uranium Processing Update. Chem. Eng., v. 82, No. 5, Mar. 3, 1975, pp. 88-89.

Some new methods of extracting uranium from difficult ores offer substantial savings in capital equipment costs. Among the processes discussed are a leaching acid type and an electrolytic reduction method.

103. Iron Age. Can Steelmen Beat the Long-Term Capacity Crunch? V. 215, No. 1, Jan. 6, 1975, pp. 85-89.

This article suggests the possibility of a steel shortage by 1978. Pricing, cash flow, and investment in the industry to expand capacity are items of interest.

J

104. Jackson, D. Advancing Longwall Mining: A First for Mid-Continent Coal and a First for the U.S. Coal Age, v. 80, No. 10, September 1975, pp. 100-105.

The first mechanized advancing longwall mining system in the United States will begin operations late in 1975. Developed by the Mid-Continent Coal and Coke Co. of Carbondale, Colo., it has required more than \$5 million in investment. One noteworthy feature of the system is its 2,500-foot operating depth. Previous conventional mining systems reached a maximum depth of 2,000 feet.

105. _____. Navajo Mine Converts to Truck/Rail, Cutting Haulage Operating Costs 25%. Coal Age, v. 80, No. 5, May 1975, pp. 52-53.

The largest coal producing mine in the United States now employs an 8-1/2-mile-long railroad to haul coal from the mine to the customer. Utah International's Navajo complex uses both truck and rail in the new haulage system, cutting operating costs by 25 percent.

106. Jackson, D., Jr. Rio Algom's Lisbon Uranium Mine in Utah Opens Up New Area of Ore Potential. Eng. and Min. J., v. 176, No. 4, April 1975, pp. 75-86.

The cost of a uranium facility located near Moab, Utah, and developed by the Rio Algom Co. is given at \$23.6 million. Extra capital outlays were required due to wetter ore caused by excessive ground water. Also, preliminary core samples indicated a higher grade of ore than that which was mined.

107. Jonakin, J. Solving the SO₂ Problem - Where We Stand With Applications and Costs. Coal Age, v. 80, No. 5, May 1975, pp. 58-65.

With the current record high price of sulfur (\$50 per ton), SO₂ removal systems will receive more consideration. Cost estimates for flue gas desulfurization (FGD) systems have ranged between \$19 and \$96 per kilowatt of capacity. The most recent cost report for FGD was prepared by the Tennessee Valley Authority (TVA) for the Environmental Protection Agency (EPA). Capital and operating costs for leading processes are shown.

K

108. Kastrop, J. E. Potential Impact of Tertiary Oil Recovery. Petrol. Eng., v. 47, No. 12, November 1975, pp. 21-23.

Graphs illustrate a comparison of accumulated cost versus time for secondary and tertiary oil recovery projects. Other economic factors including profit per barrel are compared.

109. Kearney, D. R. Ethylene Plant Size Limitations. Chem. Eng. Prog., v. 71, No. 11, November 1975, pp. 68-70.

Capital costs for ethylene plants are given with plant size being the most important economic factor. Increasing feedstocks cost and other factors are causing problems for producers. Some cost projections are made.

110. Kern, W. I. Increasing Heat Exchanger Efficiency Through Continuous Mechanical Tube Maintenance. Combustion, v. 47, No. 2, August 1975, pp. 18-26.

Mechanical tube cleaning of powerplant condensers improves performance and efficiency and decreases energy consumption and maintenance costs. Annual savings resulting from this procedure are outlined.

111. Klipstein, D. H. Improved Precipitator Performance by Gas Conditioning. Combustion, v. 47, No. 4, October 1975, pp. 43-47.

Capital and operating costs are given for sulfur oxide gas conditioning processes in powerplants. Gas conditioning significantly improves the performance of electrostatic precipitators.

112. Klooster, H. J., G. A. Vogt, and G. F. Braun. Optimizing the Design of Relief and Flare Systems. Chem. Eng. Prog., v. 71, No. 1, January 1975, pp. 39-44.

A flare system used in cleaning polluted air is discussed. A flowsheet for the system and an accompanying chart showing investment costs and return on investment analysis is provided.

113. Kondo, M., and S. Fukuda. Fluidized Bed Pre-Calcliner Boosts Heat Exchange Efficiency. Rock Products, v. 78, No. 5, May 1975, pp. 93-96, 126.

A new process for calcining cement raw materials has been developed by the Mitsubishi Mining and Cement Co. in conjunction with Mitsubishi Heavy Industries, Ltd. The process, called Fluidized Calciner Process, reduces material consumption, increases production capacity, and cuts costs in other areas. High heat exchange efficiency is responsible for substantial savings.

114. Kovacic, J. M. How To Evaluate the Effectiveness of Industrial Plant Energy Systems. Combustion, v. 47, No. 6, December 1975, pp. 21-28.

Economics of industrial power generation is considered. Methods for cutting energy costs are given.

115. Kratochvil, J. A., and H. M. Rayner. An Operations Research Approach to Minimizing Fuel Costs. Combustion, v. 48, No. 9, pp. 22-29.

This article describes a mathematical model that has been developed to aid in minimizing the total cost of alternative fuels used to generate electric power and other utilities. The model determines the optimal daily usage of natural gas from two sources in relation to the alternative use of oil. Statistics and graphs are provided.

116. Krueding, A. P. Cat Cracker Power Recovery Techniques. Chem. Eng. Prog., v. 71, No. 10, October 1975, pp. 56-61.

Processes for recovering mechanical energy from regenerator gases are discussed. The regenerator is a unit associated with a catalytic cracking system for hydrocarbons. A profitability study shows costs and investment return for power recovery systems of this type.

117. Lamoutte, H., and E. Armstrong. System Saves Utility Costs. Hydrocarbon Process., v. 54, No. 7, July 1975, pp. 91-92.

Union Carbide Co. has developed a new computerized Water and Energy Management System (WEMS) giving utility operators surer control over water and steam distribution systems. Technical details of the system are presented, and cost reductions are discussed.

118. Lantz, E. L. Impact of Environmental Regulations on Mining. Min. Cong. J., v. 61, No. 11, November 1975, pp. 48-51.

Capital expenditures for pollution control in the mining and related industries are the issue. Dollar figures are given for pollution control expenditures in different areas such as low-sulfur coal combustion and flue gas desulfurization.

119. Lawrence, J. R. Drilling Rate Affects Costs More Than Bit Life. Oil and Gas J., v. 73, No. 23, June 2, 1975, pp. 130-132.

In oil and natural gas economics, controlling well drilling costs is quite important. Two areas that lend themselves to cost improvement are drilling rate and drill bit life. A good formula is derived for figuring the footage cost for drilling, and examples are given to illustrate its application.

120. Lee, D. Reduce Tire Costs on Your Tractor Shovels. Rock Products, v. 78, No. 3, March 1975, pp. 57, 82.

Some ways to reduce tire costs for heavy loading equipment are presented. A general overview of tire types is outlined, and comparisons are made with respect to advantages and disadvantages of different types.

121. Lewis, F. M., and R. B. Bhappu. Evaluating Mining Ventures Via Feasibility Studies. Min. Eng., v. 27, No. 10, October 1975, pp. 48-54.

After a potential ore body has been discovered and funds have been obtained to develop the deposit, the next step is to estimate the costs of production. Capital and operating cost estimates are presented for various mineral ventures including a copper ore body, gold deposit, and uranium body.

122. Li, T. M. Meeting the Challenge of Material Demands From the Oceans. Min. Eng., v. 27, NO. 4, April 1975, pp. 28-30.

A capital expenditure of nearly \$800 million will be required within the next decade to bring deep-sea nodule production on-stream. The nodules carry economically recoverable amounts of manganese, cobalt, nickel, and copper.

123. Li, T. M., and R. Carter. Pinto Valley Copper Mine - Blueprint for Insured Productivity. Min. Eng., v. 27, No. 6, June 1975, pp. 25-32.

Cities Service Co. owns a new 62,500-ton-per-year copper mine and mill near Miami, Ariz. The estimated capital cost of the project is \$100 million. Mining and processing details are included.

124. Linsky, B., J. Littlepage, A. Johannes, N. Rasool, and P. Lincoln. Dry Coke Quenching, Air Pollution and Energy: A Status Report. J. APCA, v. 25, No. 9, September 1975, pp. 918-924.

The process of quenching incandescent coke after it leaves the coke ovens provides many proven advantages, including elimination of air pollutants and conservation of energy. Economics of dry quenching is discussed with operating, labor, and maintenance costs given for a Soviet system. Investment rate of return is also presented with the Soviet analysis.

125. Liptak, B. G. Higher Profits Via Advanced Instrumentation. Chem. Eng., v. 82, No. 13, June 23, 1975, pp. 152-162.

In chemical process plants, updating of instrumentation can increase production and profitability. Advanced system controls are examined with respect to capital and operating costs. A phosphate precipitation control system realizes annual savings of \$60,400. The annualized total instrument cost is \$5,800, yielding a \$54,600 profit.

126. Lobdell, W. R., and L. M. Ayers. Separators Cut Weight, Cost for Gas-Production Equipment. Oil and Gas J., v. 73, No. 10, Mar. 10, 1975, pp. 56-59.

Centrifugal-type separators for separating gas well fluids have a number of advantages. They are smaller and lighter, and they cost about one-third of what a conventional-type separator costs. A 30-inch by 10-foot by 1,440-psig vertical 3-phase centrifugal separator is quoted at about \$17,000.

127. Ludwig, E. E. Changes in Process Equipment Caused by the Energy Crisis. Chem. Eng., v. 82, No. 6, Mar. 17, 1975, pp. 61-64.

A chart gives current and estimated 1980 costs for electric power, steam, natural gas, and oil charged to the chemical process industries. Estimates to 1980 show a 30- to 40-percent increase in costs.

128. Lyon, J. R. Using Multiple Cutoff Rates for Capital Investment. J. Petrol. Technol, v. 27, July 1975, pp. 822-826.

A cutoff rate is a term referring to the practice of setting a threshold rate of return that a project must reach to be accepted. Methods for capital budgeting are outlined.

Mc

129. McCollum, R. C. Coal Management Optimizes Generation. Electrical World, v. 184, No. 9, Nov. 1, 1975, pp. 42-45.

The use of different grades of coal in boiler-type power generating plants provides many advantages for operators. One major advantage is in peak periods where lower quality coal may be used to prevent loss of capacity. Coal management can yield savings of \$400,000 or more annually.

130. McConville, L. B. The Athabasca Tar Sands. Min. Eng., v. 27, No. 1, January 1975, pp. 19-38.

A complete look at the Athabasca tar sands is presented. Included are discussions on geology and history, commercialization, surface mining, operating problems, in situ recovery, and future outlook. The commercialization section makes capital cost comparisons for different projects, and a table is given showing estimated cost per barrel for products of different grade.

131. McCrary, E. Foreign Investment Starts Pouring Into Brazil. Eng. and Min. J., v. 176, No. 11, November 1975, p. 162.

Exploration investments for minerals are continuing to increase in Brazil. Vast deposits of iron, manganese, and bauxite are attracting investments with promising metal deposit discoveries expected.

132. McGee, D. A. Uranium Industry Faces Uncertain Future. Electrical World, v. 184, No. 4, Aug. 15, 1975, pp. 30-33.

The Energy Research and Development Administration (ERDA) estimates the cost of uranium (U_3O_8) production at between \$8 and \$15 per pound. Uranium economics is the primary subject examined with discussions on government policy and pricing effect on supply and demand included.

133. McGlamery, G. G., R. L. Torstrick, W. J. Broadfoot, J. P. Simpson, L. J. Henson, S. V. Tomlinson, and J. F. Young. Detailed Cost Estimates for Advanced Effluent Desulfurization Processes. Combustion, v. 47, No. 4, October 1975, pp. 27-36.

A summary of a detailed Tennessee Valley Authority report concerning stack gas desulfurization economics is presented. Among the many areas outlined in the report are process definitions, major design and cost factors, results, and others. The actual report is one of the most detailed cost analysis studies available for desulfurization processes.

M

134. Magruder, P. S. Aliso Canyon Facility Is Giant Among Gas Storage Projects. Pipeline and Gas J., v. 202, No. 13, November 1975, pp. 20-23.

Southern California Gas Co. has built an underground gas storage facility at Aliso Canyon in the Santa Susanna Mountains, 25 miles northwest of Los Angeles, Calif. Total investment in the project is \$83 million. Investment cost is broken down into categories such as storage well development, gas conditioning facilities, piping systems. etc.

135. Maloney, K. F. Economic Potential of Steam Turbines in the HPI. Hydrocarbon Process., v. 54, No. 11, November 1975, pp. 261-264.

Electric and steam power costs are compared for turbine generators. Fuel costs are a critical issue, and combustion efficiency is a criteria for selection.

136. Mapstone, G. E. Figure Discount Cash Flow Quickly. Hydrocarbon Process., v. 54, No. 12, December 1975, pp. 99-100.

The presentation illustrates a simple way to compute return on investment. The procedure modifies discounted cash flow technique using a tabulator calculation method.

137. Mason, R. H. Colorado Firm Produces Three Million Tons at 7,000 Feet. Coal Min. and Process., v. 12, No. 11, November 1975, pp. 38-42.

A Colorado Rocky Mountain surface coal mining operation provides useful data on many different aspects of production. An average maintenance cost of \$7 per hour is cited.

138. Massey, M. J., and R. W. Dunlap. Economics and Alternatives for Sulfur Removal From Coke Oven Gas. J. APCA, v. 25, No. 10, October 1975, pp. 1019-1027.

Detailed estimates of capital and operating costs for the desulfurization of coke oven gases are examined. Different processes are compared on the basis of capital costs, operating costs, and capacities.

139. May, D. L. Cutting Boiler Fuel Costs With Combustion Controls. Chem. Eng., v. 82, No. 7, Dec. 22, 1975, pp. 53-57.

Improving combustion efficiency in boilers reduces fuel costs. Monitoring the flue gas enables one to make adjustments toward the optimum efficiency. Technique is discussed.

140. Meidav, T. Costs of Geothermal Steam Capacity. Oil and Gas J., v. 73, No. 10, Mar. 10, 1975, pp. 94-96.

Investment costs for geothermal energy are compared with those for oil, oil shale, and other sources of energy. Steam generated from geothermal wells is measured in terms of barrels per day of oil equivalent for investment cost purposes. Cost in barrels per day of oil equivalent is in the range of \$280 to \$550 per barrel per day of capacity.

141. Meritt, P. C. Project Financing: Customized Money Packages for Coal Mine Development. Coal Age, v. 80, No. 4, April 1975, pp. 98-103.

Some discussion on capital costs and investment expenditures for the coal industry is included in this interview with Wallace W. Wilson of Continental Illinois. Mr. Wilson forecasts important changes in industry financing, mainly in increasing debt-to-equity ratios for most mining companies. He states that more project financing is required.

142. Mills, R. G. Problems and Promises of Controlled Fusion Power. Mech. Eng., v. 97, No. 9, September 1975, pp. 20-25.

Capital costs are given for a 2,020-megawatt fusion powerplant. Total capital cost is estimated at \$598.60 per kilowatt of generating capacity. Major cost components include reactor and turbine plant equipment and a nuclear island.

143. Mining Congress Journal. Private Economists Foresee No Mineral Shortages. V. 61, No. 4, April 1975, pp. 38-39.

Most mineral economists don't envision mineral shortages as a real problem in the immediate future owing to evolving technology that permits exploitation of lower grade ores. However, efforts to improve environmental conditions will tend to negate technological advances from a cost standpoint. It is generally agreed that a more realistic constraint will be insufficient investment money caused by public policy, taxation, price controls, and other factors. Some suggested remedies conclude the article.

144. Mining Engineering. Drilling Research: New Bit Designs Promise Lower Drilling Costs. V. 27, No. 8, August 1975, pp. 38-40.

The Energy Research and Development Agency (ERDA) has budgeted \$500,000 to Sandia Laboratories, Albuquerque, N. Mex., for development of new drill bit designs. The new designs are expected to improve penetration and lower operating costs.

N

145. Nahas, R. S. New Olefins Techniques Offer Refiners Process Flexibility. Oil and Gas J., v. 73, No. 25, June 23, 1975, pp. 126-127.

Investment costs are given for ethylene plants with capacities of 590,000 metric tons per year production. Total installed cost for a single plant is estimated at \$191 to \$193 million.

146. Nelson, W. L. Average Process-Unit Maintenance. Process Costimating - 29 A. Oil and Gas J., v. 73, No. 13, Mar. 31, 1975, pp. 77-78.

Maintenance costs for refineries are the topic of this article. Costs are given as a percentage of total investment for refineries with capacities of from 10,000 to 20,000 barrels per day.

147. _____. Chemical and Catalyst Costs. Oil and Gas J., v. 73, No. 4, Jan. 27, 1975, pp. 165-166.

Chemical costs and trends are the subject of this article. Prices for chemicals rose sharply in 1974 leading to a 32-cent-per-barrel higher chemicals cost. Some tables provide cost information for refineries.

148. _____. Complexity vs. Costs for Majors, Independents. Process Costimating - 105 C. Oil and Gas J., v. 73, No. 38, Sept. 22, 1975, pp. 108-109.

Investment costs are given for oil refineries in dollars per barrel of producing capacity. Refinery capacity ranges from 7,250 to 346,000 barrels per stream day.

149. _____. Detailed Refinery Operating Costs - 6. Total Costs Versus Capacity and Complexity. Process Costimating - 5 D. Oil and Gas J., v. 73, No. 8, Feb. 24, 1975, pp. 55-57.

Operating cost data for U.S. refineries is given in three separate tables. Labor, energy, chemicals, maintenance, and water are some inputs for which costs are discussed. Some graphs show operating costs per barrel with respect to capacity for different plants.

150. _____. Duplication Raises Costs in U.S. Refineries. Process Costimating - 105 B. Oil and Gas J., v. 73, No. 36, Sept. 8, 1975, pp. 72-73.

Oil refinery investment costs are given as a function of capacity for 1973. A major cost escalator is the duplication of process units, which accounted for a 15-percent increase in existing refinery costs in 1973.

151. _____. Fuel, Investment Govern Refinery-Steam Cost. Process Costimating - 18 A. Oil and Gas J., v. 73, No. 50, Dec. 15, 1975, pp. 87, 89.

Oil refinery steam costs are given for the years 1956-74. Items considered in estimating costs include feedwater, labor, investment, maintenance, and fuel.

152. _____. Here's a Look at Productivity in Design and Erection of Refineries - 1973 and the Future. Productivity Costimating - 76. Oil and Gas J., v. 73, No. 19, May 12, 1975, pp. 100-102.

Refinery construction costs rise every year because of inflation, but the costs are held in check to some degree by the productivity attained in the skills of design and erection. Using 1946 as a base year, Nelson shows how to incorporate productivity gains into construction cost estimates.

153. _____. Joint-Product Costing - Calculating Value by Alternate Uses. Process Costimating - 156 B. Oil and Gas J., v. 73, No. 25, June 23, 1975, pp. 99-100.

A useful way to analyze joint-product economics is the alternative use method. Intermediate crude oil products can be processed in many ways, each way leading to a different group of finished products. Examples and charts are provided for illustration of the method.

154. _____. Joint-Product Costing Methods Accountants Suggest. Process Costimating - 156. Oil and Gas J., v. 73, No. 18, May 5, 1975, pp. 242-250.

Costing of oil refinery products is relatively perplexing because selling prices in a joint-product industry do not equal the costs of manufacture. The author attempts to establish a more reasonable market structure by acknowledging manufacturing costs and other competitive factors.

155. _____. Joint-Product Costing: 1973 Manufacturing Cost of Products. Process Costimating - 156 A. Oil and Gas J., v. 73, No. 23, June 2, 1975, pp. 123-126.

An illustration of the price structure for refined crude products is shown. Manufacturing costs are given for distillates, fuel oils, asphalt, naphtha, and gases.

156. _____. Maintenance and Operating Costs for U.S. Plants. Process Costimating - 151 B. Oil and Gas J., v. 73, No. 39, Sept. 29, 1975, pp. 122-124.

As is suggested in the title, Nelson reviews maintenance and operating cost trends for U.S. oil refineries. Charts and graphs illustrate cost features giving maintenance in cents per barrel and operating cost in dollars per barrel. Maintenance costs average 11.9 cents per barrel, and operating costs average \$1.16 per barrel.

157. _____. Maintenance Material and Labor. Process Costimating - 151
A. Detailed Refinery Operating Costs - 3. Oil and Gas J.,
v. 73, No. 2, Jan. 13, 1975, pp. 57-59.

The cost of U.S. refinery maintenance has declined since 1956. The cost was about 15 cents per barrel in 1959 and was only 11.7 cents in 1973. Better materials and contract maintenance are credited with this cost reduction.

158. _____. Nelson Refinery Cost Indexes. Oil and Gas J.

Refinery cost indexes appear monthly and consist of two parts: (1) Refinery construction cost index (1946 basis) and (2) refinery operating cost indexes (1956 basis).

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159. _____. Quarterly Costimating. Oil and Gas J.

Appearing quarterly, these tables show monthly and yearly average value of the Nelson Refinery Construction Index. The indexes cover costs of plants, processes, equipment, and associated items for refineries.

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159-2	73	14	Apr. 7, 1975	130-131
159-3	73	27	July 7, 1975	72-73
159-4	73	40	Oct. 6, 1975	72-73

160. _____. Refinery Construction Costs Keep on Climbing. Oil and Gas J., v. 73, No. 4, Jan. 27, 1975, p. 146.

This article gives a graph showing the trend of the Nelson refinery (inflation) construction cost index. It rose 56.6 points in 1974 alone. The effects of environmental and energy costs continue to confuse the projection of construction costs.

161. _____. Sulfur-Recovery Provides Steam. Process Costimating - 79 C. Oil and Gas J., v. 73, No. 47, Nov. 24, 1975, p. 51.

Investment and operating costs are given for processes to recover sulfur from gas purification systems in refineries.

162. _____. What Are Costs of Tanker Transportation? Process Costimating - 144 A. Oil and Gas J., v. 73, No. 16, Apr. 21, 1975, pp. 92-94.

A review of bulk tanker transport costs is presented. Tables show such things as average tanker transport costs for different parts of the world and break-even cost for tanker operations.

163. _____. What Will Products Cost in 1975-78? Process Costimating - 157. Oil and Gas J., v. 73, No. 41, Oct. 13, 1975, pp. 93-94.

Manufacturing costs for petroleum products are given. Operating costs are rapidly becoming secondary to raw crude cost as the major expense of manufacture. Crude oil may account for 75 to 95 percent of total manufacturing cost.

164. Nielson, G. F. Coal Mine Development Survey Shows 236.6 Million Tons of New Capacity. Coal Age, v. 80, No. 2, February 1975, pp. 130-136.

A fairly complete report is provided showing new coal-producing capacity in U.S. coalfields. Tables are contained giving names and locations of new mines and production facilities.

165. Nilsen, J. M. Money Woes. Chem. Eng., v. 82, No. 3, Feb. 3, 1975, pp. 28-30.

The electric utility industry slowdown is due to many different factors. The determination of rate increases by government agencies is the key financial factor. Construction delays and inflation will continue to impair growth for the industry.

166. Nisenfeld, A. E. Cost Comparisons of Analog-Control and Computer-Control Systems. Chem. Eng., v. 82, No. 17, Aug. 18, 1975, pp. 104-108.

Chemical processing plants require some sort of analog or computer control in certain processing areas. Control schemes are discussed with respect to reliability and logic, and cost comparisons are made between analog and digital systems.

167. Noble, G. Public Invited In On Planning for \$30 Million Facility. Coal Min. and Process., v. 12, No. 1, January 1975, pp. 66, 68-70.

A western coal transshipment terminal designed by the Orba Corp. will require an investment of \$30 million and will transship 8 million tons of western coal annually.

168. Noran, D. Innovative Workover/Drilling Rigs To Utilize Hydraulics. Oil and Gas J., v. 73, No. 39, Sept. 29, 1975, pp. 90-92, 94, 98.

Western Gear Corp. of Everett, Wash., is building two hydraulic-type workover/drilling rigs. One is an offshore platform with a cost of about \$650,000. The other is a land rig costing about \$585,000.

169. Norden, R. B. CPI '75 Capital Spending Plans High, But Trimmed. Chem. Eng., v. 82, No. 10, May 12, 1975, pp. 48-52.

The chemical process industries in the United States are planning capital expenditures of \$20.63 billion in 1975. A chart breaks down industry expenditures for chemicals, rubber, pulp and paper, metals, and others.

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170. Oil and Gas Journal. CO₂ Removal Cost Cut \$550,000/Year - Petrochemicals. V. 73, No. 11, Mar. 17, 1975, pp. 107-110.

Employing a corrosion inhibition optimization program, Mississippi Chemical Corp. was able to cut operating costs by \$550,000 per year in their aqueous monoethanolamine (MEA) removal section. Details of the system are discussed.

171. _____. Steam Traps Can Save Utility Costs. V. 73, No. 19, May 12, 1975, pp. 100-102.

Steam loss due to faulty steam traps in refineries can cause losses above \$400,000 per year when steam is estimated to cost \$1 per thousand pounds. With rising fuel costs, steam may reach a \$3-per-thousand-pound figure. More justification for installation and maintenance of good traps is presented.

172. Olds, F. C. Environmental Cleanup 1975-1985: Huge New Costs, Little Benefit. Power Eng., v. 79, No. 9, September 1975, pp. 38-45.

Costs of environmental cleanup in the power generation industry are measured with consideration given to many different aspects of pollution control. Capital outlays are given for years past, and a trend showing the cost buildup is outlined. Nuclear powerplant costs and cost trends are also viewed.

173. _____. Nuclear Standards and Standard Nuclear Plants: More Than Money Is At Stake. Power Eng., v. 79, NO. 3, March 1975, pp. 42-49.

Some plant costs for nuclear power generating facilities are given. The subject of standardization in nuclear construction is discussed with respect to formulating and implementing standards. The cost per kilowatt electrical generating capacity is quoted at about \$304 for 1975.

174. Oleson, K. A., F. J. Valansky, R. C. Twombly, Jr., and R. J. Budenholzer. Economics Favor Mechanical-Draft Towers. Electrical World, v. 184, No. 2, July 15, 1975, pp. 40-43.

The economic evaluation described compares total evaluated costs for powerplant cooling systems using mechanical or natural draft cooling towers. The results show that the system using mechanical draft towers has about an 18-percent lower cost than the one employing natural draft towers.

175. Olmsted, L. M. 19th Steam Station Cost Survey. Electrical World, v. 184, No. 10, Nov. 15, 1975, pp. 43-58.

Capital, operating, fuel, and other costs are discussed for power generating steam plants. Charts and graphs illustrate cost changes, overtime for construction, fixed charges, different fuels, etc.

176. O'Neal, A. J., Jr. The Dollar Value of Protecting Steam Turbines Against Fouling. Combustion, v. 47, No. 5, November 1975, pp. 20-23.

Steam contamination by solid particles can cause turbine problems in power generators. Turbine failures mean costly overhauls and repairs. Costs and methods for controlling steam purity are discussed.

P

177. Palladino, A. P. Finance Plan Key to Success of New Terminal. Coal Min. and Process., v. 12, No. 5, May 1975, pp. 48-49.

The Superior Coal Transshipment Terminal, Superior, Wis., is being financed in such a way that annual savings are expected to exceed \$1 million when compared with conventional financing.

The location characteristics of the terminal establish an eligibility for Industrial Development Bond financing. This financing plus reduced capital and operating costs inherent in the facilities design yield a very low, intermodal cost per ton.

178. Papamarcos, J. System Planning Amidst Roadblocks and Confusion. Power Eng., v. 79, No. 5, May 1975, pp. 26-35.

Difficulties in energy systems planning are manifested by deepening recession and productivity drops. Increasing financial problems also obscure the planning function. To help understand what the power generating utilities are up against, the article presents a review of industry happenings in the problem areas.

179. Parker, C. L., and C. C. Fong. Fluoride Removal: Technology and Cost Estimates. Industrial Wastes, v. 21, No. 6, November/December 1975, pp. 23-27.

Capital, operating, and chemical costs are given for processes to remove fluoride from waste waters. Comparisons are made among different treatments, and technical details on each process are included.

180. Paul, J. E. Application of Electrostatic Precipitators for the Control of Fumes From Low Odor Pulp Mill Recovery Boilers. J. APCA, v. 25, No. 2, February 1975, pp. 158-162.

Capital cost of an electrostatic precipitator for application to a low odor recovery boiler is quoted in the range of \$5.50 to \$6.50 per actual cubic foot per minute of capacity erected. This is 30 percent higher than the capital outlay required for a traditional electrostatic precipitator system.

181. Perkins, R. L. Maintenance Costs and Equipment Reliability. Chem. Eng., v. 82, No. 7, Mar. 31, 1975, pp. 126-128.

A discussion on how to control maintenance costs in chemical plants is presented. A formula is given to determine equipment reliability and cost of maintenance.

182. Peterson, M. L. Steel Selection for Offshore Structures. J. Petrol. Technol., v. 27, March 1975, pp. 274-282.

Economic considerations for steel selection are discussed for offshore drilling structures. Costs are estimated as a percent of total with materials (steel and pipe) representing 25 to 35 percent of the total. Fabrication, installation, and miscellaneous cost components are included.

183. Petkovsek, J. C. Economics Favor Industrial Power Generation With Steam From High Pressure Boilers. Combustion, v. 47, No. 6, December 1975, pp. 10-15.

Investment, operating, labor, and maintenance costs are studied for power generation in industrial plants, using high-pressure steam and turbine generators.

184. Petty, W. J. The Capital Expenditure Decision-Making Process of Large Corporations. Eng. Econ., v. 20, No. 3, Spring 1975, pp. 159-172.

Current capital budgeting procedures for large corporations are outlined. Specific items include (1) the objective of the firm relating to investment opportunities, (2) evaluation methodology used in analyzing proposed capital expenditures, and (3) the acceptance criteria presently being employed by the firm. Collected data indicates that a large number of companies are using the discounted cash flow technique in the analysis of capital projects.

185. Pfoutz, B. D., and L. L. Stewart. Electrostatic Precipitators - Materials of Construction. Chem. Eng. Prog., v. 71, No. 3, March 1975, pp. 53-75.

Some comparison is made of materials used for construction of electrostatic precipitators. A table shows costs per thousand square inches of stainless steel, fiber glass, lead sheet, etc. Fabrication costs are excluded.

186. Plouf, T. M. How Frother Savings Can Become Expensive. Min. Eng., v. 27, No. 11, November 1975, pp. 33-34.

Flotation of minerals is a method by which the valuable portion of a finely ground ore is concentrated. Costs of flotation are discussed with specific frother costs given for copper ore. Other examples show actual results from frother testing.

187. Powers, P. N. Coal, Nuclear Industries Play Complementary Roles. Coal Min. and Process., v. 12, No. 8, August 1975, pp. 51-53.

The capital costs of coal power generation are less than those for nuclear, but for nuclear, fuel costs are lower. New coal mines and unit trains require capital in the range from \$90 to \$110 per kilowatt of capacity. For nuclear power generation it's near \$56. Some discussion on fuel costs is included.

188. Prescott, J. H. Oil Giants Gear Up Petrochemicals Capacity. Chem. Eng., v. 82, No. 7, Mar. 31, 1975, pp. 56-58.

Some current capital spending figures for expansion in the petrochemicals industry are given. McGraw-Hill capital-spending survey (November 1974) shows U.S. investment in petrochemicals in 1975 will be up about 50 percent and that capital spending in refining will also be up by about the same percentage.

189. Pundari, N. B. Estimate of Reclamation Costs Resulting From Federal Law. Coal Age, v. 80, No. 4, April 1975, pp. 127-131.

The new Federal strip mining law carries many new cost implications. Reclamation and other aspects of surface mining will become more expensive. The author displays a model for estimating tangible costs of strip mining using specific mine parameters such as seam thickness and swell factor of the overburden. Intangible costs such as drainage treatment and refuse layering are discussed and given a cost-per-acre figure.

R

190. Rao, K. V., H. Christopher, and J. R. Lucas. Coal Productive Potential of Diesel Load-Haul-Dump Equipment and Systems. Min. Cong. J., v. 61, No. 12, December 1975, pp. 18-23.

Capital investment, depreciation, power, and labor costs are given for an underground coal mine loader and shuttle car system, and a new diesel load-haul-dump unit.

191. Rashmi, P. Equipment for Controlling Gaseous Pollutants. Chem. Eng., v. 82, No. 21, Oct. 6, 1975, pp. 129-133.

Capital and installation costs are discussed for equipment used in processes to remove pollutants from gas streams in the chemicals processing industry.

192. Rennick, G. E., and J. Pasini. Gas Well Sealing Projects Portend Recovery of Coal Otherwise Lost. Coal Min. and Process., v. 12, No. 11, November 1975, pp. 52-54, 68.

Penetration of oil and gas wells has proven a major obstacle in deep coal mining. The authors discuss a well plugging procedure that may enable operators to extract coal that was previously unminable. Costs and savings are also viewed.

193. Rettew, R., and E. E. Murphy. Heading-Off the High Cost of Cleaning Up Mine Openings. Coal Age, v. 80, No. 5, May 1975, pp. 70-72.

In compliance with the Federal Coal Mine Health and Safety Act of 1969, mining entryways must be cleaned regularly to maintain the openings. Costs for this operation are very high and vary with certain conditions. Methods for sloughing cleanup are discussed, and some suggestions on cost-cutting are given.

194. Rex, M. J. Choosing Equipment for Process Energy Recovery. Chem. Eng., v. 82, No. 16, Aug. 4, 1975, pp. 98-102.

The increasing costs of energy and raw materials have caused capital and operating cost control to shift to energy and material efficient designs. Some technical aspects of equipment design are discussed with respect to cost efficiency.

195. Ricci, L. J. C.E. Cost Indexes Accelerate 10-Year Climb. Chem. Eng., v. 82, No. 9, Apr. 28, 1975, pp. 117-118.

The C.E. cost index rose 32.7 points during 1972-74. The rise was spurred by a record 15-percent increase in 1974 alone. Comparisons and trends are shown for different cost indexes relating major components such as equipment, labor, materials, etc.

196. Richards, W. M. Switch to Catalytic Exhaust Purifiers Cuts Maintenance Costs at Copper Mine. Eng. and Min. J., v. 176, No. 10, October 1975, pp. 102-103.

Catalytic dry scrubber exhaust conditioners are being used on diesel machinery at the White Pine Copper Co.'s White Pine copper mine in Michigan. Maintenance costs are lower because little production time is lost for equipment replacement. The old water scrubber technique caused maintenance problems in many areas.

197. Riggs, E. D., and E. R. Brownscombe. New Sonic Shock Tool Removes Well Bore Flow Barriers. Petrol. Eng., v. 47, No. 10, September 1975, pp. 68, 72, 74.

Oil wells may develop flow barriers such as scale mineral deposits. A new technique using sonic shock waves pulverizes the blockages, saving time and money. On the first 22 wells treated with the sonic tool, a 19-percent increase in production was realized.

198. Roberts, J. W., C. A. Mangold, and A. T. Rossano. Cost and Benefits of Road Dust Control in Seattle's Industrial Valley. J. APCA, v. 25, No. 9, September 1975, pp. 948-952.

The City of Seattle Engineering Department estimated an annual saving in maintenance of \$2,665 per year per mile after a road with considerable dust emission was seal coated. Cost benefit analysis of particulate air pollution control is examined in detail with major emphasis on road dust.

199. Rock Products. Estimating Dust Control Costs for Crushed Stone Plants. V. 78, No. 4, April 1975, pp. 49-53.

Capital and operating costs are given for dust control and abatement systems in rock crushing plants. Included in the report are dollar figures for different capacity fabric filter systems and wet suppression systems. The associated annual operating costs are given also. Total capital investment for the process discussed ranges from \$49,129 to \$249,162.

200. Rosain, R. M. Understanding the EPA's Effluent Guidelines and Standards. Power Eng., v. 79, No. 4, April 1975, pp. 55-58.

The Environmental Protection Agency has set guidelines that will govern the thermal and chemical quality of effluents from power-plants. The new standards are expected to increase capital and operating costs substantially. A table shows estimated increases in these costs.

201. Ross, B. A., and P. D. Martinka. Western Coal Transportation - A Challenge. Min. Cong. J., v. 61, No. 4, April 1975, pp. 40-45.

Owing to the vast distances separating coal mining and marketing areas in the Western United States, great expansion in railways and loading facilities is necessary. An estimated cost of new rail line construction is cited at \$300,000 per mile. Natural waterways and slurry pipelines are also reviewed for feasibility and economics.

202. Ruggeri, S. Stack Gas Scrubbing - The "Com" Viewpoint. Combustion, v. 47, No. 4, October 1975, pp. 16-22.

Capital and operating costs are given for different type stack gas scrubbers (installed) for sulfur removal. Capital costs range from \$19 to \$124 per kilowatt of capacity.

203. Rymarz, T. M., and D. H. Klipstein. Removing Particulates From Gases. Chem. Eng., v. 82, No. 21, Oct. 6, 1975, pp. 113-120.

Installation, maintenance, and operating costs are given for electrostatic precipitators. Certain cost advantages are inherent in precipitators over other equipment for particulate removal.

S

204. Savay, A. C. Effects of Inflation and Escalation on Plant Costs. Chem. Eng., v. 82, No. 14, July 7, 1975, pp. 78-80.

In the latter half of 1973 and through 1974, chemical processing plant component costs took a sharp jump. Causes for this rise are discussed, and some suggestions on how to minimize their effects are outlined.

205. Schneider, G. G., T. I. Horzella, J. Cooper, and P. J. Striegl. Selecting and Specifying Electrostatic Precipitators. Chem. Eng., v. 82, No. 11, May 26, 1975, pp. 94-108.

A complete, detailed presentation of industrial electrostatic precipitators is offered. Beginning with some discussion on the particulate-containing gases that pass through the precipitators, the authors proceed to neatly outline various structural and related considerations used as criteria for equipment selection. The concluding information concerns economics of the systems, giving capital, operating, and maintenance cost insight.

206. Scott, J. U.S. Deep Wells Decline in 1974. Petrol. Eng., v. 47, No. 3, March 1975, pp. 27-31.

Costs for drilling deep oil wells are on a consistent rise. Cost per completed well is in the area of \$84 per foot, up from \$63.50 per foot in 1973. A series of charts shows different geographic areas with relative cost information for drilling.

207. _____. U.S. Natural Gas: What's the Score Now? Petrol. Eng., v. 47, No. 2, February 1975, pp. 23-26.

Terminating utility-type control of natural gas wells, or deregulating interstate wellhead prices, may be the long-run solution to natural gas supply. Natural gas economics is the item of interest in this report.

208. Sharma, S. N., R. R. Beck, and D. B. George. Process Analysis and Economics of Flash Technology. J. Metals, v. 27, No. 8, August 1975, pp. 7-13.

Flash processes are examined as a means of controlling copper smelter emissions at the Utah Copper Div. of Kennecott Copper Corp. A flash process called Noranda has an estimated capital cost of \$194 million and an annual operating cost of \$45.4 million.

209. Shore, B. Replacement Decisions Under Capital Budgeting Constraints. Eng. Econ., v. 20, No. 4, Summer 1975, pp. 243-256.

The planning problem of when to replace existing equipment is subject to the complexity of forecasting. In a progressive technology the economic life of some future machine may be worth waiting for. These future evaluations are necessary for making legitimate comparisons, and the author illustrates how this may be accomplished.

210. Sisselman, R. Ocean Miners Take Soundings on Legal Problems, Development Alternatives. Eng. and Min. J., v. 176, No. 4, April 1975, pp. 75-86.

The Pacific Ocean floor contains vast amounts of mineral nodules representing billions of dollars worth of nickel, copper, cobalt, and manganese. This report studies different factors related to sea mining and provides cost comparisons and financial results for different nodule mining and processing methods.

211. _____. Rosario Dominicana Launches Latin America's Largest Gold Mine. Eng. and Min. J., v. 176, No. 10, October 1975, pp. 71-78.

The Dominican Republic has a \$45 million opencut gold mine beginning operation in Pueblo Viejo that represents the second largest gold producer in the Western Hemisphere. Various investment and operating cost figures are given.

212. Smith, D. E. Prior Review of Drilling-Related Costs Saves \$250,000 in Texas Infill-Drilling Program. Oil and Gas J., v. 73, No. 24, June 16, 1975, pp. 62-66.

Reviewing drilling related cost items during a drilling program reduces costs. Particular areas that lend themselves to this procedure are examined.

213. Smith, R. S. Improve Economics of Acid-Gas Treatment. Oil and Gas J., v. 73, No. 10, Mar. 10, 1975, pp. 78-82.

Improving the economics of acid-gas treatment plants involves changing the acid gas treatment chemical and/or improving the energy efficiency of the process. Some example problems show how to examine the economics of process conversion and how to cut capital and operating costs.

214. Smith, S. There's a Lot More to a Coal Gasification Project Than Process. Pipeline and Gas J., v. 202, No. 3, Mar. 1, 1975, pp. 36, 40, 43.

Some investment figures for coal gasification processes are given. It is estimated that a coal gasification complex to supply energy for a town with a population of 5,000 would require a capital outlay of about \$26 million.

215. Snyder, R. E. Big Wells. World Oil, v. 180, No. 2, January 1975, pp. 75-78.

Methods and equipment for field-wide gas injection and crude handling of wells in a Texas oilfield are the items of interest here. Some drilling cost information is provided.

216. Spoor, B. New Yugoslav Ferronickel Project Is Slated To Be Largest in Europe. Eng. and Min. J., v. 176, No. 9, September 1975, pp. 112-113.

The Arthur G. McKee Co. will be the major foreign contractor for a Yugoslavian ferronickel project scheduled for startup in 1978. Total investment is estimated at \$209 million. Processing, production, and marketing details accompany the report, and cost estimates for labor, operation, and transport are included. A description of financing for the project concludes the study.

217. Stambaugh, E. P. Battelle Develops Leaching Process To Desulfurize Coal. Coal Age, v. 80, No. 9, August 1975, pp. 72-74.

The Battelle Hydrothermal Coal Process for removing sulfur from high-sulfur coal was announced in June 1975 by Battelle Laboratories in Columbus, Ohio. Dr. Sherwood L. Fawcett, Battelle's president, said that the process can be at least 20 percent less expensive than any alternate process.

218. Stauffer, T. R. Economics Favor Breeder Deployment. Electrical World, v. 184, No. 1, July 1, 1975, pp. 32-36.

Economic analysis of the liquid metal fast breeder reactor (LMFBR) shows that substantial electricity cost savings could be realized in deployment of the LMFBR. Capital costs for the system are compared with those of fossil fuel systems in 1975 present worth dollars.

219. Steiner, P., and W. F. Bischoff, Jr. Coal Converts SO₂ to S. Chem. Eng., v. 82, No. 1, Jan. 6, 1975, pp. 74-75.

A new process called RESOX curbs sulfur dioxide emissions and is scheduled for commercial startup at a capital cost of about \$6.50 per kilowatt of power generated. This represents about 10 percent of total pollution control expense.

220. Straton, J. W. 1970-1974 - A Period of Adverse Changes in Productivity and Costs at Underground Bituminous Coal Mines. Min. Cong. J., v. 61, No. 10, October 1975, pp. 34-39.

Comparisons are made among underground bituminous coal mines on the basis of capacity, type of mining, added cost per ton overtime, and other factors. The median added cost per ton from 1969 to 1974 was \$3.50 to \$4 for independent mines and \$2 to \$2.50 for captive mines.

221. Stuart, D. O., and R. D. Meckna. Accounting for Inflation in Present-Worth Studies. Power Eng., v. 79, No. 2, February 1975, pp. 45-47.

Comparing costs at the beginning of an accounting period requires a present worth analysis. All future receipts must be discounted to accurately determine their present value. This article shows how inflation may be accounted for by adjusting present worth factors.

222. Suboleski, S. Boost Your Productivity by Adding Continuous Miners. Coal Age, v. 80, No. 3, March 1975, pp. 78-80.

A new continuous mining method for increasing productivity is outlined. It is suggested that having a second mining unit in each underground section cuts nonproductive time dramatically. A return on investment analysis is provided to show the profitability of the system.

223. Sweeny, F. J. On-Site Disposal of Sludges From Effluent Treatment Plant Cuts Costs. Oil and Gas J., v. 73, No. 27, July 7, 1975, pp. 52-54.

Refineries produce great amounts of biological and waste water treatment sludges that require costly operations to dispose of them. Economical methods for sludge disposal are viewed with respect to sites and different waste materials.

I

224. Tamaki, A. The Thoroughbred 101 Desulfurization Process - SO₂ Processing. Chem. Eng. Prog., v. 71, No. 5, May 1975, pp. 55-58.

Material, operating, and utility costs are given for the utility boiler flue gas desulfurization system mentioned in the title. Labor expenses and catalyst costs are among the items discussed.

225. Tanner, A. L., C. R. Cooper, and E. F. Drucker. Costs Key to Turbine Choice for LNG Plants. Oil and Gas J., v. 73, No. 50, Dec. 15, 1975, pp. 60-62, 67-68.

Economic analysis of compressor drivers for liquid natural gas plants is studied. Cost items shown include initial equipment, installation, and fuel.

226. Thomas, R. A. The Dollars and Sense of Selecting Wear Materials. Eng. and Min. J., v. 176, No. 7, July 1975, pp. 83-88.

In the comminuting phase of mineral processing, ores are mechanically reduced in size by primary and secondary crushing and by grinding in various types of mills. The mill linings are subject to great abrasion and require frequent replacement. Costs per pound for various materials used for mill linings are given.

227. Tinsley, R. C. Economics of Deep Ocean Resources - A Question of Manganese or No Manganese. Min. Eng., v. 27, No. 4, April 1975, pp. 31-33.

Capital and operating cost estimates for deep-sea mining facilities are discussed. Accurate estimates are said to be closely guarded industrial secrets, but one published estimate sets capital costs in a range from \$25 to \$238 million. Operating costs range from \$34.50 to \$50 per ton for processing mineral nodules with manganese recovery. Another estimate gives a \$10 to \$15 range without manganese recovery.

228. Trauffer, W. E. Portland Cement. Pit and Quarry, v. 67, No. 7, July 1975, pp. 53-67.

The economics of the portland cement industry went through considerable changes in 1974. High demand and cement shortages have given way to low demand and overcapacity. Price changes are discussed.

229. Tyer, B. R. Oxygenation Equipment--Aerators and Pure Oxygen Systems. Chem. Eng., v. 82, No. 21, Oct. 6, 1975, pp. 75-77.

Costs of oxygenating water using aerators or pure oxygen systems are given. Direct oxygenation of the water has certain advantages, one being a low, 8-cent-per-pound cost for dissolved oxygen.

230. Tyreus, B. D., and W. L. Luyben. Two Towers Cheaper Than One? Hydrocarbon Process., v. 54, No. 7, July 1975, pp. 93-94.

Higher fuel costs warrant the use of a two-tower refinery distillation system rather than one because the two-tower system uses less energy. Profitability indicators of the system are given using rate of return before tax and discounted cash flow rate of return.

U

231. Ushio, S. Japan's NO_x Cleanup Routes. Chem. Eng., v. 82, No. 15, July 21, 1975, pp. 70-71.

Japanese engineers are busy perfecting pollution control processes for NO_x emission due to tough standards set by government. Capital and operating costs for systems are outlined.

232. Ushio, S., and C. S. Cronan. Japan's CPI Modify Growth Plans. Chem. Eng., v. 82, No. 16, Aug. 4, 1975, pp. 90-97.

The chemical process industries in Japan view government regulation on NO_x emissions as a serious cost problem. No process for emission

control has proved workable at industrial scale. Capital spending figures for pollution abatement are given for the years 1973-75 in different areas of chemical processing.

V

233. Vasan, S. The Citrex Process for SO₂ Removal - SO₂ Processing. Chem. Eng. Prog., v. 71, No. 5, May 1975, pp. 61-65.

Capital and operating costs are compared for two SO₂ removal systems for a 200-megawatt-capacity, coal-fired boiler. Citrex and limestone SO₂ removal processes are compared on an advantage-disadvantage basis.

234. Villar, J. W., and G. A. Dawe. The Tilden Mine--A New Processing Technique for Iron Ore. Min. Cong. J., v. 61, No. 10, October 1975, pp. 40-48.

The Tilden iron mine complex located about 3-1/2 miles south of Ipshemung, Mich., employs a new processing technique to produce 4 million long tons of iron pellets per year. Capital costs related to the facilities exceed \$200 million.

235. Vyas, K. C., and W. W. Bodle. Coal and Oil-Shale Conversion Looks Better. Oil and Gas J., v. 73, No. 12, Mar. 24, 1975, pp. 45-54.

Synthetic fuel processes are examined. Process descriptions are given for Lurgi and Hygas gasification systems. Operating and labor costs are viewed, and a valuable table showing components of capital investment for the systems is included.

W

236. Wahanik, R. J. Multiport Water-Intake To Cut Construction Costs. Electrical World, v. 184, No. 3, Aug. 1, 1975, p. 59.

A new 2,400-megawatt nuclear powerplant being built on the shore of Lake Erie near Cleveland, Ohio, was able to achieve significant reductions in estimated construction costs. Adopting a design recommended by consulting engineers, the constructors were able to modify a submerged offshore intake structure resulting in lower costs. Technical details are examined.

237. Wallace, R. L. Capacitors Reduce System Investment and Losses. Electrical World, v. 184, No. 9, Nov. 1, 1975, pp. 54-55.

Capacitors serve as an effective cost reduction tool in electric power generation. They reduce operating costs and allow new load transmission with a smaller investment. Some examples are given to show how a relatively small investment in capacitors may eliminate the need for investing in other, more expensive equipment.

238. Wasp, E. J. Plus Factors for Coal Slurry Pipelines. Coal Min. and Process., v. 12, No. 9, September 1975, pp. 68-71.

Coal slurry pipelines have many advantages over other forms of coal transport. Economic and environmental benefits make it a more attractive mode of transport, with substantial cost reductions in energy input a major factor. Other aspects of bulk material logistics are viewed.

239. Water and Sewage Works. Submersible lift Stations Cut Pump Maintenance Costs. V. 122, No. 8, August 1975, pp. 64-65.

A submersible pump can aid in cutting maintenance costs where waste water treatment is necessary. Specific examples are cited.

240. West, J., and S. Kelly. U.S. Oils' Profits Skid Sharply From Stellar '74. Oil and Gas J., v. 73, No. 18, May 5, 1975, pp. 143-148.

Capital costs are estimated to be 10 times higher for oil production in the North Sea than in other parts of the world. North Sea estimates range from \$5,000 to \$7,000 per barrel per day of production capacity compared with only \$500 to \$700 per barrel per day in the Middle East. Other costs for oil production are given, and some discussion on how the oil depletion loss is affecting industry capital spending is included.

241. Whelan, T. Instrumentation Costs in the HPI. Hydrocarbon Process., v. 54, No. 9, September 1975, pp. 185-188.

A method for estimating installed costs of process instrumentation for oil refineries and chemical plants is presented. Instrument direct costs range from 5-1/2 to 7 percent of total direct costs. Other costs including material, labor, and shipping are discussed.

242. Wollaston, E. G., W. J. Haflin, W. D. Ford, and G. J. D'Souza. What Influences Cat Cracking. Hydrocarbon Process., v. 54, No. 9, September 1975, pp. 93-100.

Investment costs for a new type fluid catalytic cracking unit (FCCU) are given. Total investment is estimated near \$20.3 million.

243. World Oil. Gas Ceiling Price Raised. V. 180, No. 1, January 1975, p. 7.

The Federal Power Commission raised the interstate natural gas ceiling price from 42 to 50 cents per thousand standard cubic feet. The influence on interstate gas supply should be minimal.

244. _____. Industry Capital Spending Reaches All-Time High. V. 180, No. 4, March 1975, p. 58.

Capital expenditure figures for the petroleum industry are given. Expenditures reached the \$30 billion mark in 1973. A breakdown chart shows investments in production, processing, transportation, marketing, and other segments of the industry and reflects the changes between the years 1972 and 1973.

245. _____. Loss of Percentage Depletion Could Curtail U.S. Drilling. V. 180, No. 2, Feb. 1, 1975, pp. 27-29.

In an interview, Sanford E. McCormick, president of McCormick Oil and Gas Corp., Houston, Tex., stated that if the oil depletion provision were removed his firm would have 30 to 35 percent less cash flow to operate with. Some discussion of capital expenditures and pricing effect on supply and demand is included.

Y

246. Yocum, B. T. Examples Show How To Cut Costs. Minimizing Production Costs - 3 (Conclusion). Oil and Gas J., v. 73, No. 20, May 19, 1975, pp. 110-112.

Oil and gas producers are constantly searching for the most economical solution to oil and gas field development. The author outlines the design of an offshore field multiwell-gathering-network producing system and an Arctic pipeline configuration. Substantial cost reductions are possible with proper design.

247. _____. How To Pare Investments in Your Production Systems: Minimizing Production Costs - 2. Oil and Gas J., v. 73, No. 18, May 5, 1975, pp. 237-239.

Achieving maximum economic recovery of oil and gas while minimizing investments requires optimization of existing producing systems and long-range field plans. Optimization technique is the item of concern in this article.

248. Young, D., and L. E. Contreras. Expected Present Worths of Cash Flows Under Uncertain Timing. Eng. Econ., v. 20, No. 4, Summer 1975, pp. 257-267.

The maximization of present worth is highly desirable and academic in most engineering economic decisions. When both the amounts and timings of cash flows are uncertain, expected present worth cannot be calculated by the usual methods. The authors outline steps to be taken when uncertainty is prevalent and illustrate new methods involving statistical models.

249. Yu, A. T. Lower Cost Energy and Higher Quality Coke Through Coal Blending. Coal Age, v. 80, No. 10, September 1975, pp. 112-117.

This report gives an estimated cost for coal gasification at \$4 per million Btu. Cost of eastern coal as a conventional fuel is \$1 per million Btu. Also, a suggested method for reducing sulfur content in fuel, coal blending, is described with related economic advantages.

Z

250. Zimmerman, A. Iron-Ore Concentration Process Unlocks Low-Grade Reserves. Chem. Eng., v. 82, No. 23, Oct. 27, 1975, pp. 73-75.

A new process for beneficiating a nonmagnetic iron ore involves a selective-floculation desliming treatment followed by froth flotation. The Cleveland Cliffs Iron Co. in conjunction with the Federal Bureau of Mines has developed the technique, and a 4-million-ton-per-year plant is in operation at Tilden, Mich. Total investment is near \$200 million with expansion programs underway.

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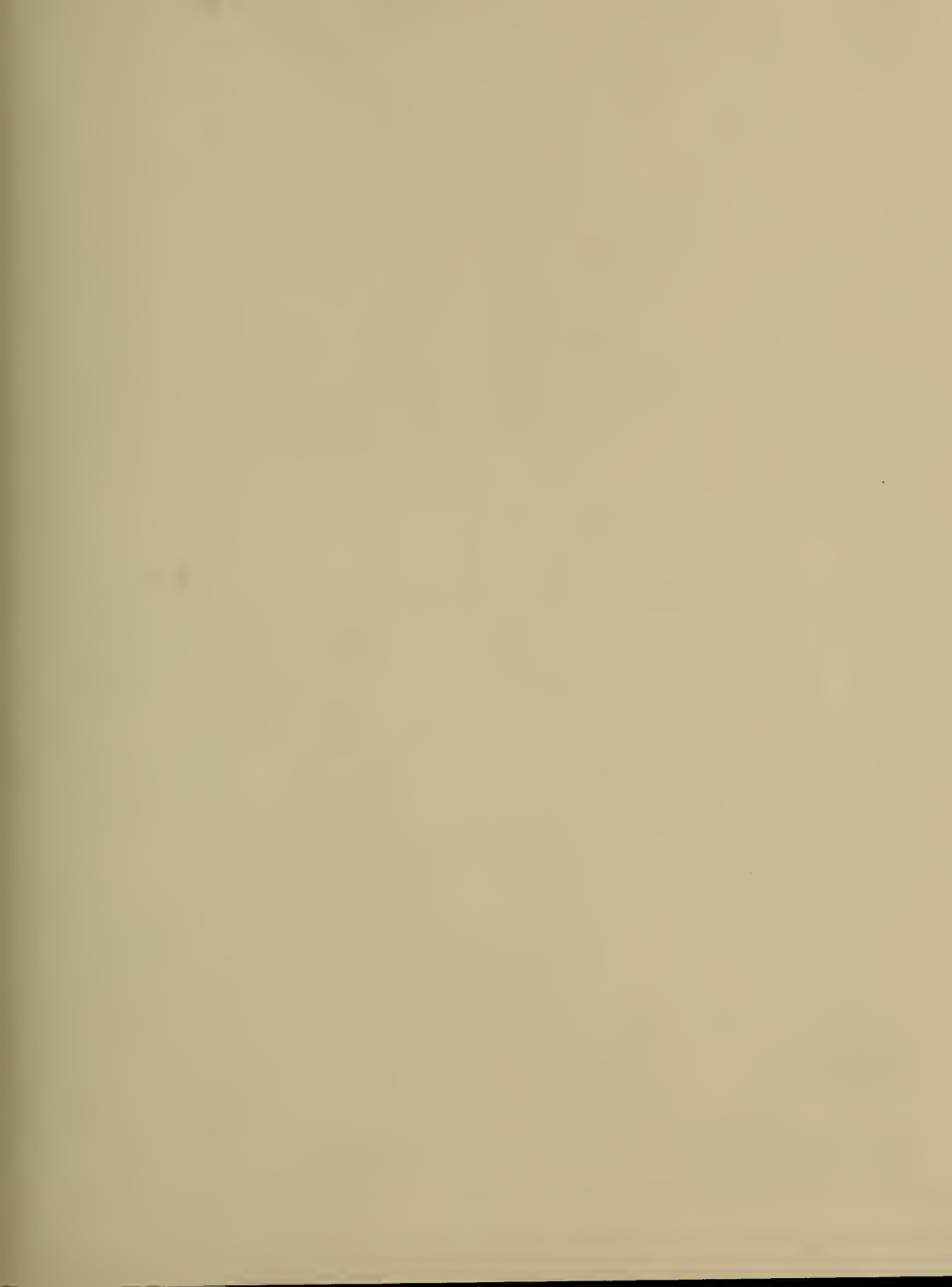
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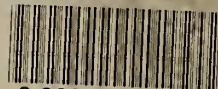




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